

## **WHAT IS CLAIMED IS:**

1. A cemented carbide blank suitable for fabrication by electric discharge machining, the cemented carbide blank comprising:

5 tungsten carbide present in an amount equal to between about 80 weight percent and about 90.9 weight percent of the cemented carbide blank;

chromium present in an amount equal to between about 0.3 weight percent and about 1.5 weight percent of the cemented carbide blank;

10 cobalt present in an amount equal to between about 8 weight percent and about 14 weight percent of the cemented carbide blank;

nickel present in an amount equal to between about 0.7 weight percent and about 1.3 weight percent of the cemented carbide blank; and

15 molybdenum present in an amount equal to between about 0.1 weight percent and about 0.3 weight percent of the cemented carbide blank; and

the cemented carbide blank having a magnetic saturation as measured according to  
ASTM B886-03 ranging between about  $151 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt and  
20 about  $171 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt.

2. The cemented carbide blank of claim 1 comprising:

tungsten carbide present in an amount equal to between about 86 weight percent and about 88 weight percent of the cemented carbide blank; the chromium present in an amount equal to between about 0.6 weight percent and about 1.2 weight percent of the cemented carbide blank, the cobalt present in an amount equal to between about 10 weight percent and about 12 weight percent of

the cemented carbide blank, and the nickel present in an amount equal to between about 0.9 weight percent and about 1.1 weight percent of the cemented carbide blank.

3. The cemented carbide blank of claim 1 wherein the chromium  
5 comprises between about 1.9 weight percent and about 14 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, the nickel comprises between about 4.3 weight percent and about 14.4 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, and the molybdenum comprises between about 0.6 weight percent and about 3.3 weight  
10 percent of the sum of the cobalt and chromium and nickel and molybdenum.

4. The cemented carbide blank of claim 1 wherein the chromium comprises between about 4.3 weight percent and about 10 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, the nickel comprises between about 6.4 weight percent and about 9.2 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, and the molybdenum comprises between about 0.6 weight percent and about 3.3 weight  
15 percent of the sum of the cobalt and chromium and nickel and molybdenum.

5. The cemented carbide blank of claim 1 wherein the hardness as measured according to ASTM B294-92(2000) ranges between about 88 HRA and  
20 about 92 HRA.

6. The cemented carbide blank of claim 1 wherein the porosity as measured according to ASTM B276-91(2000) is better than A06 B02 C00.

7. The cemented carbide blank of claim 1 wherein the transverse rupture strength as measured according to ASTM B406-96(2000) ranges between  
25 about 3300 MPa and about 3700 MPa.

8. The cemented carbide blank of claim 1 wherein the density as measured according to ASTM B311-93(2000) ranges between about 14.0 and about 14.4 grams per cubic centimeter.

9. The cemented carbide blank of claim 1 wherein the coercive force ( $H_C$ ) measured B887-03 ranges between about 110 oersteds and about 170 oersteds.
10. The cemented carbide blank of claim 1 wherein the magnetic saturation as measured according to ASTM B886-03 ranges between about to  $151 \times 10^{-6} \text{ T m}^3 / \text{kilogram cobalt}$  and about to  $161 \times 10^{-6} \text{ T m}^3 / \text{kilogram cobalt}$ .
11. The cemented carbide blank of claim 1 wherein the cemented carbide blank has an absence of eta phase therein.
12. A cemented carbide body made by electric discharge machining, the cemented carbide body comprising:
  - a body presenting a selected shape, and the body comprising:
    - tungsten carbide present in an amount equal to between about 80 weight percent and about 90.9 weight percent of the cemented carbide body;
    - chromium present in an amount equal to between about 0.3 weight percent and about 1.5 weight percent of the cemented carbide body;
    - cobalt present in an amount equal to between about 8 weight percent and about 14 weight percent of the cemented carbide body;
    - nickel present in an amount equal to between about 0.7 weight percent and about 1.3 weight percent of the cemented carbide body;
    - and
    - molybdenum present in an amount equal to between about 0.1 weight percent and about 0.3 weight percent of the cemented carbide body;
  - the cemented carbide body having a magnetic saturation as

measured according to ASTM B886-03 ranging between about  $151 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt and about  $171 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt.

13. The cemented carbide body of claim 12 wherein the cemented carbide body presents one or more surfaces wherein each one of the surfaces is  
5 essentially free of defects caused by the electric discharge machining.

14. The cemented carbide body of claim 12 comprising the tungsten carbide present in an amount equal to between about 86 weight percent and about 88 weight percent of the cemented carbide blank, the chromium present in an amount equal to between about 0.6 weight percent and about 1.2 weight  
10 percent of the cemented carbide blank, the cobalt present in an amount equal to between about 10 weight percent and about 12 weight percent of the cemented carbide blank, and the nickel present in an amount equal to between about 0.9 weight percent and about 1.1 weight percent of the cemented carbide blank.

15. The cemented carbide body of claim 12 wherein the chromium comprises between about 1.9 weight percent and about 14 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, the nickel comprises between about 4.3 weight percent and about 14.4 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, and the molybdenum comprises between about 0.6 weight percent and about 3.3 weight  
20 percent of the sum of the cobalt and chromium and nickel and molybdenum.

16. The cemented carbide body of claim 12 wherein the chromium comprises between about 4.3 weight percent and about 10 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, the nickel comprises between about 6.4 weight percent and about 9.2 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, and the molybdenum comprises between about 0.6 weight percent and about 3.3 weight percent of the sum of the cobalt and chromium and nickel and molybdenum.  
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17. The cemented carbide body of claim 12 wherein the hardness

as measured according to ASTM B294-92(2001) ranges between about 88 HRA and about 92 HRA.

18. The cemented carbide body of claim 12 wherein the transverse  
rupture strength as measured according to ASTM B406-96(2000) ranges between  
5 about 3300 MPa and about 3700 MPa.

19. A cemented carbide blank suitable for fabrication by electric  
discharge machining, the cemented carbide blank comprising:

10 a carbide phase present in an amount equal to between about 88.5 weight percent and about 93.6 weight percent of the cemented carbide blank wherein the carbide phase includes tungsten and vanadium and carbon;

chromium present in an amount equal to between about 0.3 weight percent and about 0.9 weight percent of the cemented carbide blank;

15 cobalt present in an amount equal to between about 6 weight percent and about 10 weight percent of the cemented carbide blank; and

20 molybdenum present in an amount equal to between about 0.1 weight percent and about 0.6 weight percent of the cemented carbide blank; and

the cemented carbide blank having a magnetic saturation as measured according to ASTM B886-03 ranging between about  $151 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt and about  $171 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt.

25 20. The cemented carbide blank of claim 19 wherein the chromium comprises between about 3 weight percent and about 15.8 weight percent of the sum of the cobalt and chromium and molybdenum, and the molybdenum

comprises between about 1 weight percent and about 10.5 weight percent of the sum of the cobalt and chromium and molybdenum.

21. The cemented carbide blank of claim 19 wherein the chromium comprises between about 3 weight percent and about 8 weight percent of the sum of the cobalt and chromium and molybdenum, and the molybdenum comprises between about 1 weight percent and about 5 weight percent of the sum of the cobalt and chromium and molybdenum.

22. The cemented carbide blank of claim 19 wherein the hardness as measured according to ASTM B294-92(2001) ranges between about 91 HRA and about 94 HRA.

23. The cemented carbide blank of claim 19 wherein the porosity as measured according to ASTM B276-91(2000) is better than A06 B02 C00.

24. The cemented carbide blank of claim 19 wherein the transverse rupture strength as measured according to ASTM B406-96(2000) ranges between about 3300 MPa and about 3700 MPa.

25. The cemented carbide blank of claim 19 wherein the density as measured according to ASTM B311-93(2000) ranges between about 14.3 and about 15.0 grams per cubic centimeter.

26. The cemented carbide blank of claim 19 wherein the coercive force ( $H_C$ ) measured B887-03 ranges between about 260 oersteds and about 310 oersteds.

27. The cemented carbide blank of claim 19 wherein the magnetic saturation as measured according to ASTM B886-03 ranges between about  $151 \times 10^{-6} \text{ T m}^3 / \text{kilogram cobalt}$  and about  $160.8 \times 10^{-6} \text{ T m}^3 / \text{kilogram cobalt}$ .

28. The cemented carbide blank of claim 19 wherein the cemented carbide blank has an absence of eta phase therein.

29. A cemented carbide body made by electric discharge machining, the cemented carbide body comprising:

a body presenting a selected shape, and the body comprising:

5 a carbide phase present in an amount equal to between about 88.5 weight percent and about 93.6 weight percent of the cemented carbide body wherein the carbide phase includes tungsten and vanadium and carbon;

10 chromium present in an amount equal to between about 0.3 weight percent and about 0.9 weight percent of the cemented carbide body;

cobalt present in an amount equal to between about 6 weight percent and about 10 weight percent of the cemented carbide body;

15 molybdenum present in an amount equal to between about 0.1 weight percent and about 0.3 weight percent of the cemented carbide blank;

the cemented carbide body having a magnetic saturation as measured according to ASTM B886-03 ranging between about  $151 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt and about  $171 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt.

30. The cemented carbide body of claim 29 wherein the cemented carbide body presents one or more surfaces wherein each one of the surfaces is  
20 essentially free of defects caused by the electric discharge machining.

31 The cemented carbide body of claim 29 wherein the chromium comprises between about 3 weight percent and about 8 weight percent of the sum of the cobalt and chromium and molybdenum, and the molybdenum comprises between about 1 weight percent and about 5 weight percent of the sum of the  
25 cobalt and chromium and molybdenum.

32. The cemented carbide body of claim 29 wherein the hardness

as measured according to ASTM B294-92(2001) ranges between about 91 HRA and about 94 HRA.

33. The cemented carbide body of claim 29 wherein the transverse  
rupture strength as measured according to ASTM B406-96(2000) ranges between  
5 about 3300 MPa and about 3700 MPa.

34. A cemented carbide blank suitable for fabrication by electric  
discharge machining, the cemented carbide blank comprising:

10 tungsten carbide present in an amount equal to between about 77.7 weight percent and about 87.9 weight percent of the cemented carbide blank;

chromium present in an amount equal to between about 0.4 weight percent and about 1.3 weight percent of the cemented carbide blank;

15 cobalt present in an amount equal to between about 9.5 weight percent and about 15 weight percent of the cemented carbide blank;

nickel present in an amount equal to between about 2 weight percent and about 5 weight percent of the cemented carbide blank;  
and

20 molybdenum present in an amount equal to between about 0.2 weight percent and about 1.0 weight percent of the cemented carbide blank; and

the cemented carbide blank having a magnetic saturation as measured according to ASTM B886-03 ranging between about  $151 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt and about  $182 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt.

25 35. The cemented carbide blank of claim 34 wherein the chromium comprises between about 2 weight percent and about 10 weight percent of the sum

of the cobalt and chromium and nickel and molybdenum, the nickel comprises between about 10 weight percent and about 33 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, and the molybdenum comprises between about 1 weight percent and about 7.8 weight percent of the 5 sum of the cobalt and chromium and nickel and molybdenum.

36. The cemented carbide blank of claim 34 wherein the hardness as measured according to ASTM B294-92(2001) ranges between about 87 HRA and about 91 HRA.

37. The cemented carbide blank of claim 34 wherein the porosity 10 as measured according to ASTM B276-91(2000) is better than A06 B02 C00.

38. The cemented carbide blank of claim 34 wherein the transverse rupture strength as measured according to ASTM B406-96(2000) is at least about 3200 MPa.

39. The cemented carbide blank of claim 34 wherein the density as 15 measured according to ASTM B311-93(2000) ranges between about 13.5 and about 15.0 grams per cubic centimeter.

40. The cemented carbide blank of claim 34 wherein the coercive force ( $H_C$ ) measured B887-03 ranges between about 80 oersteds and about 150 oersteds.

20 41. The cemented carbide blank of claim 34 wherein the magnetic saturation as measured according to ASTM B8860-03 ranges between about to  $151 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt and about to  $171 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt.

42. The cemented carbide blank of claim 34 wherein the cemented carbide blank has an absence of eta phase therein.

25 43. A cemented carbide body made by electric discharge machining, the cemented carbide body comprising:

- a body presenting a selected shape, and the body comprising:
- tungsten carbide present in an amount equal to between about 77.7 weight percent and about 87.9 weight percent of the cemented carbide body; and
- 5 chromium present in an amount equal to between about 0.4 weight percent and about 1.3 weight percent of the cemented carbide body;
- cobalt present in an amount equal to between about 9.5 weight percent and about 15 weight percent of the cemented carbide body;
- 10 nickel present in an amount equal to between about 2 weight percent and about 5 weight percent of the cemented carbide body; and
- molybdenum present in an amount equal to between about 0.2 weight percent and about 1.0 weight percent of the cemented carbide body;
- 15 the cemented carbide body having a magnetic saturation as measured according to ASTM B886-03 ranging between about  $151 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt and about  $182 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt.
44. The cemented carbide body of claim 43 wherein the cemented carbide body presents one or more surfaces wherein each one of the surfaces is  
20 essentially free of defects caused by the electric discharge machining.
45. The cemented carbide body of claim 43 wherein the chromium comprises between about 2 weight percent and about 10 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, and the nickel comprises between about 10 weight percent and about 33 weight percent of the sum of the cobalt and chromium and nickel and molybdenum, and the molybdenum  
25 comprises between about 1 weight percent and about 7.8 weight percent of the

sum of the cobalt and chromium and nickel and molybdenum.

46. The cemented carbide body of claim 43 wherein the hardness as measured according to ASTM B294-92(2001) ranges between about 87 HRA and about 91 HRA.

5 47. The cemented carbide body of claim 43 wherein the transverse rupture strength as measured according to ASTM B406-96(2000) is at least about 3200 MPa.

48. A cemented carbide blank suitable for fabrication by electric discharge machining, the cemented carbide blank comprising:

10 tungsten carbide present in an amount equal to between about 81.1 weight percent and about 86.4 weight percent of the cemented carbide blank;

15 chromium present in an amount equal to between about 0.4 weight percent and about 1.3 weight percent of the cemented carbide blank;

cobalt present in an amount equal to between about 13 weight percent and about 17 weight percent of the cemented carbide blank; and

20 molybdenum present in an amount equal to between about 0.2 weight percent and about 0.6 weight percent of the cemented carbide blank; and

the cemented carbide blank having a magnetic saturation as measured according to ASTM B886-03 ranging between about  $151 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt and about  $182 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt.

25 49. The cemented carbide blank of claim 48 wherein the chromium comprises between about 2 weight percent and about 10 weight percent of the sum

of the cobalt and chromium and molybdenum, and the molybdenum comprises between about 1 weight percent and about 4.4 weight percent of the sum of the cobalt and chromium and molybdenum.

5. 50. The cemented carbide blank of claim 48 wherein the hardness as measured according to ASTM B294-92(2001) ranges between about 88 HRA and about 90 HRA.

5. 51. The cemented carbide blank of claim 48 wherein the porosity as measured according to ASTM B276-91(2000) is better than or equal to A04 B00 C00.

10 52. The cemented carbide blank of claim 48 wherein the transverse rupture strength as measured according to ASTM B406-96(2000) ranges between about 3800 MPa and about 4200 MPa.

15 53. The cemented carbide blank of claim 48 wherein the density as measured according to ASTM B311-93(2000) ranges between about 13.7 and about 14.3 grams per cubic centimeter.

54. The cemented carbide blank of claim 48 wherein the coercive force ( $H_c$ ) measured B887-03 ranges between about 180 oersteds and about 230 oersteds.

20 55. The cemented carbide blank of claim 48 wherein the cemented carbide blank has an absence of eta phase therein.

56. A cemented carbide body made by electric discharge machining, the cemented carbide body comprising:

a body presenting a selected shape, and the body comprising:  
25 tungsten carbide present in an amount equal to between about 81.1 weight percent and about 86.4 weight percent of the cemented carbide blank;

chromium present in an amount equal to between about 0.4 weight percent and about 1.3 weight percent of the cemented carbide blank;

5 cobalt present in an amount equal to between about 13 weight percent and about 17 weight percent of the cemented carbide blank; and

molybdenum present in an amount equal to between about 0.2 weight percent and about 0.6 weight percent of the cemented carbide blank; and

10 the cemented carbide blank having a magnetic saturation as measured according to ASTM B886-03 ranging between about  $151 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt and about  $182 \times 10^{-6}$  T m<sup>3</sup> / kilogram cobalt.

57. The cemented carbide body of claim 56 wherein the cemented carbide body presents one or more surfaces wherein each one of the surfaces is  
15 essentially free of defects caused by the electric discharge machining.

58 The cemented carbide body of claim 56 wherein the chromium comprises between about 2 weight percent and about 10 weight percent of the sum of the cobalt and chromium and molybdenum, and the molybdenum comprises between about 1 weight percent and about 4.4 weight percent of the sum of the  
20 cobalt and chromium and molybdenum.